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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/073,066	02/12/2002	Suzette K. Pangre	50432-104	2391

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MCDERMOTT WILL & EMERY
600 13TH STREET, N.W.
WASHINGTON, DC 20005-3096

EXAMINER

NGUYEN, THANH T

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 12/17/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/073,066

Applicant(s)

PANGRLE ET AL.

Examiner

Thanh T. Nguyen

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 October 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) 16 and 17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 2/12/02 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1 1/2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION***Election/Restrictions***

Applicant's election with traverse of group I (claims 1-15) in Paper No. 6 is acknowledged. The traversal is on the ground(s) that search of the method claims would uncover relevant art to the composite structure claims. This is not found persuasive because method and product are statutorily distinct categories of invention, and the particular method claimed is distinct from the particular product claimed because there is an alternative method of making the product. Therefore, there is no reason why a search for product must include a search for the method as well. The existence of an alternative method of making the product, as well as the different classification of two inventions, provide evidence of burden on the examiner in examining both inventions. (see MPEP §§ 802.01, 806.04, 808.01). And, distinctness between a process of making and the product made is shown if "the product as claimed can be made by another and materially different process." MPEP § 806.05(f). In the restriction requirement, the examiner set forth a "materially different processes" by which the claimed product could be made. And, a serious burden on the examiner has shown in the restriction requirement in according to the criteria of MPEP § 808.02, the examiner set forth separate classifications for the two inventions to which claims were presented. Classification of the composite structure claims is in class 257. Classification of the process claims is in class 438. Applicant has not alleged that either composite structure or process claims were improperly classified. Nor has applicant alleged that the classifications set forth are not "separate classifications." Thus requirements of MPEP § 803 is met.

Art Unit: 2813

For these reasons set forth above, the restriction requirement is still deemed proper and is therefore made FINAL.

Claims 16 and 17 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected with traverse, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 8.

Information Disclosure Statement

The information disclosure statement filed on 2/12/02 has been considered. The PTO-1449 attached thereto has been initialed to indicate consideration of the references and is attached to this paper.

Oath/Declaration

Declaration filed on June 27, 2002 has been received.

Drawings

The drawings filed on February 12, 2002 are objected by the Draftsperson under 37 CFR 1.84 or 1.152 as indicated in the PTO-948 and is attached to this paper.

Specification

The disclosure is objected to because of the following informalities:

On page 1, lines 10-12, it is required to fill in the serial numbers, filing dates of the co-pending U.S. patents and/or applications. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Usami (U.S. Patent No. 6,133,137) in view of the Mikagi (U.S. Patent No. 6,153,507).

Usami teaches in figures 2, 3A-3F a method of forming a composite dielectric on a substrate, the method comprising:

Forming a dielectric layer (204, called "insulating layer" in Usami, see col. 4, lines 42-45) on the substrate (201, see figure 3C, col. 4, lines 28-29 and col. 5, lines 30-42),

Forming a patterned photoresist (206, see figure 3C, col. 4, lines 57-61) on the dielectric layer (204),

Etching through the dielectric layer (204) to expose surface therein (surface inside through hole 207, see figure 3D, col. 4, lines 64-67, meeting claims 1, 6 and 9), and

Treating the exposed surface of the dielectric layer (204/209, see figure 3F,) with phosphine gas or plasma (col. 5, lines 34-41 and claim 1 of Usami, meeting claims 1, 7 and 9), and

Forming a cap layer (107, see figure 2, col. 4, lines 16-18) directly on the treated surface (106/209) of the dielectric layer (204, meeting claim 1).

Regarding to claim 2, forming the dielectric layer (204) by spin-on-glass techniques (SOG, see figure 3b, col. 4, lines 42-45 and col. 2, lines 19-20).

Art Unit: 2813

Regarding to claim 8, forming the dielectric layer (204) from a silsesquioxane dielectric material or derivative thereof (HSQ, see col. 4, lines 42-45 and col. 1, lines 24-29 and figure 3B).

Regarding to claim 10, removing the photoresist layer (206, see figure 3E, col. 5, lines 3-4), and

Forming a conformal barrier layer (see col. 4, lines 17-19 and figure 2, not shown) on the dielectric layer (204, inside the through hole 207, see figures 2 and 3F) including the phosphine plasma treated side surfaces thereof (106/209, see figures 2 and 3F and col. 5, lines 34-41).

Regarding to claim 11, forming a conductive layer (107) comprising copper (107, see figure 2, col. 4, lines 16-19) on the conformal barrier layer (see figure 2, col. 4, lines 17-19) and within the etched dielectric layer (204, see figures 2 and 3F, col. 4, lines 16-19).

Regarding to claim 12, polishing the conductive layer (see figure 2, col. 3, lines 65-68) to the barrier layer (see figure 2, col. 4, lines 17-19) to form a conductive trench or plug (107, see figure 2, col. 4, lines 16-19) within the dielectric layer (204).

Regarding to claim 13, forming a cap layer (108, see figure 2) over the conductive layer (107) and barrier layer (see col. 4, lines 17-19, not shown in figure 2).

Regarding to claim 14, the dielectric layer (204) comprises a porous silicon oxide (see figure 3B, col. 4, lines 42-45 and col. 1, lines 26-28).

Regarding to claim 15, depositing the silicon oxide (204) at a thickness of about 0.3 microns to about 1 micron (4000 Å or 0.4 microns, see col. 4, lines 40-41).

Usami teaches forming a composite dielectric layer on a substrate, using an ECR plasma chamber to generate plasma (see col. 5, lines 13-15) and forming a cap layer as described above. However, Usami does not teach using a semiconductor substrate (as claimed in claims 1 and 9),

Art Unit: 2813

introducing the substrate to a PECVD chamber, introducing phosphine together with a carrier gas to the PECVD chamber as the phosphine source, forming the cap layer by PECVD without removing the substrate from the chamber (as claimed in claims 3-5). Nevertheless, using a semiconductor substrate, introducing the substrate to a PECVD chamber, introducing phosphine together with a carrier gas to the PECVD chamber as the phosphine source, forming the cap layer by PECVD without removing the substrate from the chamber are known in semiconductor processing art as evidenced by Mikagi. Mikagi teaches using a semiconductor substrate (101, a silicon, see figure 6A, col. 7, lines 34-35) (meeting claims 1 and 9), introducing the substrate to a PECVD chamber and PECVD is a ECR plasma chamber (see col. 8, lines 25-29) (meeting claim 3), introducing phosphine (see col. 8, lines 33-36) together with a carrier gas (nitrogen, an inert gas, in Mikagi, see col. 8, lines 58-61) to the PECVD chamber as the phosphine source (see col. 8, lines 33-45, meeting claim 4), forming the cap layer (110a, see col. 8, lines 62-67) by PECVD without removing the substrate from the chamber (see col. 8, lines 66-67, meeting in claim 5).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time the invention was made would use a semiconductor substrate to form a semiconductor device and recognize that ECR plasma chamber is a PECVD chamber for forming a composite dielectric on a semiconductor substrate, introducing the substrate to a PECVD chamber, introducing phosphine together with a carrier gas to the PECVD chamber as the phosphine source, forming the cap layer by PECVD without removing the substrate from the chamber in the process of Usami as taught by Mikagi *because* semiconductor device can be formed directly on the semiconductor substrate without the need of forming an epitaxial semiconductor layer on the substrate that is not a semiconductor substrate, and PECVD chamber generates high density

Art Unit: 2813

plasma for forming highly uniform dielectric layer, and the surface of dielectric layer treated with phosphine gas or plasma increases adhesion and preventing moisture in the copper via plug.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (703) 308-9439, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 7:00AM to 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (703) 308-4940. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See MPEP 203.08).



Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN
October 24, 2002